

What is Claimed is:

1. A system for sensing and compensating for at least one error signal, the system comprising:

an acoustic pick-up device having a first microphone disposed at a first distance from a desired acoustic source, and a second microphone disposed at a second distance from the desired acoustic source, each of the first microphone and the second microphone

receiving acoustic signals generated from the desired acoustic source, and in response, transducing the acoustic signals into audio signals;

a position estimation circuit coupled to receive the audio signals from the first microphone and the second microphone, and adapted to produce therefrom the error signal representing an estimate of the acoustic pick-up device being positioned differently than intended with respect to the desired acoustic source, the position estimation circuit including a first circuit providing an average of corresponding magnitudes for the audio signals received from the first microphone and the second microphone to produce the error signal; and

a controller using the error signal to compensate for the acoustic pick-up device being positioned differently than intended by providing the audio signals from at least one of the first microphone and the second microphone to an output.

1           2. The system according to Claim 1, wherein the first circuit comprises a first  
2 absolute value detector coupled to a first envelope detector, and a second absolute value  
3 detector coupled to a second envelope detector, the first absolute value detector receiving  
4 the audio signals from the first microphone, and the second absolute value detector  
5 receiving the audio signals from the second microphone.

1           3. The system according to Claim 2, further comprising an indicator utilizing the  
2 error signal to generate a indication of the acoustic pick-up device being positioned  
3 differently than intended.

1           4. The system according to Claim 3, wherein the indicator comprises a visual  
2 indicator.

1           5. The system according to Claim 4, wherein the visual indicator comprises a  
2 light emitting diode disposed proximate to the pick-up device.

1           6. The system according to Claim 4, wherein the visual indicator comprises a  
2 light emitting diode disposed on the pick-up device.

1           7. The system according to Claim 4, wherein the visual indicator comprises a  
2 light emitting diode that is a plug-in accessory for the pick-up device.

1           8. The system according to Claim 4, further comprising a headset coupled to the  
2 acoustic pick-up device, wherein the visual indicator comprises a light emitting diode  
3 disposed on the headset.

1           9. The system according to Claim 4, further comprising a headset coupled to the  
2   acoustic pick-up device, wherein the visual indicator comprises a light emitting diode that  
3   is a plug-in accessory for the headset.

1           10. The system according to Claim 4, further comprising a handset coupled to the  
2   acoustic pick-up device, wherein the visual indicator comprises a light emitting diode  
3   disposed on the handset.

1           11. The system according to Claim 4, further comprising a handset coupled to the  
2   acoustic pick-up device, wherein the visual indicator comprises a light emitting diode that  
3   is a plug-in accessory for the handset.

1           12. The system according to Claim 3, wherein the indicator comprises an audio  
2   indicator.

1           13. The system according to Claim 12, wherein the audio indicator comprises a  
2   tone generator positioned on the pick-up device, and a speaker coupled to the tone  
3   generator.

1           14. The system according to Claim 12, wherein the audio indicator comprises a  
2   tone generator that is a plug-in accessory for the pick-up device.

1           15. The system according to Claim 12, further comprising a headset coupled to  
2   the acoustic pick-up device, wherein the audio indicator comprises a tone generator  
3   disposed on the headset.

1           16. The system according to Claim 12, further comprising a headset coupled to  
2     the acoustic pick-up device, wherein the audio indicator comprises a tone generator that  
3     is a plug-in accessory for the headset.

1           17. The system according to Claim 12, further comprising a handset coupled to  
2     the acoustic pick-up device, wherein the audio indicator comprises a tone generator  
3     disposed on the handset.

1           18. The system according to Claim 12, further comprising a handset coupled to  
2     the acoustic pick-up device, wherein the audio indicator comprises a tone generator that  
3     is a plug-in accessory for the handset.

1           19. The system according to Claim 3, wherein the indicator comprises a sensory  
2     indicator.

1           20. The system according to Claim 19, wherein the sensory indicator comprises a  
2     motion generator disposed on the pick-up device.

1           21. The system according to Claim 19, wherein the sensory indicator comprises a  
2     motion generator that is a plug-in accessory for the pick-up device.

1           22. The system according to Claim 19, further comprising a headset coupled to  
2     the acoustic pick-up device, wherein the sensory indicator comprises a motion generator  
3     disposed on the headset.

0985472-05101  
FOI 50 2745860

1           23. The system according to Claim 19, further comprising a headset coupled to  
2           the acoustic pick-up device, wherein the sensory indicator comprises a motion generator  
3           that is a plug-in accessory for the headset.

1           24. The system according to Claim 19, further comprising a handset coupled to  
2           the acoustic pick-up device, wherein the sensory indicator comprises a motion generator  
3           disposed on the handset.

1           25. The system according to Claim 19, further comprising a handset coupled to  
2           the acoustic pick-up device, wherein the sensory indicator comprises a motion generator  
3           that is a plug-in accessory for the handset.

1           26. The system according to Claim 1, wherein the error signal is determined after  
2           the audio signals are received by the position estimation circuit.

1           27. The system according to Claim 1, wherein the first microphone and the  
2           second microphone are both omnidirectional microphones.

1           28. The system according to Claim 27, further comprising a noise canceling  
2           microphone signal generated by a difference between the audio signals received from the  
3           first microphone and the audio signals received from the second microphone.

1           29. The system according to Claim 1, wherein the position estimation circuit  
2           detects the acoustic pick-up device being positioned differently than intended by using a

3 ratio of the audio signals received from the first microphone to the audio signals received  
4 from the second microphone.

1 30. The system according to Claim 1, wherein the first microphone is an  
2 omnidirectional microphone and the second microphone is a directional microphone.

1 31. The system according to Claim 1, wherein the controller includes a switch  
2 transferring the audio signals from one of the first and the second microphones to the  
3 output.

1 32. The system according to Claim 1, wherein the controller includes a switch  
2 transferring a combined signal to the output, the combined signal generated from a  
3 difference between the audio signals received from the first microphone and the audio  
4 signal received from the second microphone.

1 33. The system according to Claim 1, wherein the controller includes:  
2 a device adapted to produce a combined signal based on the audio signals  
3 received from the first and the second microphones, wherein the error signal  
4 is used to select the combined signal to be transmitted to the output.

1 34. The system according to Claim 33, wherein the device comprises a  
2 differential amplifier.

1 35. The system according to Claim 1, wherein the position estimation circuit  
2 comprises a sensor capable of determining the acoustic pick-up device being positioned  
3 differently than intended.

1        36. The system according to Claim 1, wherein the controller includes:  
2        a programmable phase shift network adapted to produce a range of phase shifts in  
3        the audio signals from the second microphone; and  
4        a device producing a combined signal based on those signals being phase shifted  
5        and on the audio signals received from the first microphone, the device being  
6        further capable of transferring the combined signal to the output.

1        37. The system according to Claim 36, wherein the device comprises a  
2        differential amplifier.

1        38. The system according to Claim 1, wherein the first microphone is disposed  
2        closer to the desired acoustic source than the second microphone.

1        39. The system according to Claim 1, wherein the position estimation circuit  
2        comprises:  
3        a device determining whether the desired acoustic source is operational; and  
4        coupled to the device, a sensor determining that the acoustic pick-up device is  
5        positioned differently than intended.

1        40. The system according to Claim 39, wherein the audio signals from at least  
2        one of the first microphone and the second microphone are provided to the output when  
3        the acoustic source is operational and when the sensor determines that the acoustic pick-  
4        up device is positioned differently than intended according to a predetermined threshold  
5        that is exceeded.

1           41. The system according to Claim 39, wherein the position estimation circuit  
2 further comprises:  
3           a second circuit determining progressive levels of the acoustic pick-up device  
4           being positioned differently than intended with respect to the desired acoustic  
5           source; and  
6           a third circuit determining a corresponding phase shift based on a particular one  
7           of the progressive levels determined, said corresponding phase shift being  
8           introduced with the audio signals received from the second microphone to  
9           produce delayed signals, the delayed signals being subtracted from the audio  
10          signals received from the first microphone to provide the output.

1           42. The system according to Claim 39, wherein second circuit comprises a multi-  
2 level comparator, and the third circuit comprises a state machine coupled to the multi-  
3 level comparator.

1           43. The system according to Claim 39, wherein the corresponding phase shift  
2 causes a directional response of the second microphone to have a response pattern  
3 including one of a figure eight pattern, a cardioid pattern, a hypercardioid pattern, and an  
4 omnidirectional pattern.

1           44. The system according to Claim 1, further comprising a headset having the  
2 first microphone and the second microphone disposed thereon, wherein the first  
3 microphone is disposed closer to the desired acoustic source than the second microphone.



1 45. The system according to Claim 1, further comprising a handset having the  
2 first microphone and the second microphone disposed thereon, wherein the first  
3 microphone is closer to the desired acoustic source than the second microphone.

1 46. The system according to Claim 1, wherein the position estimation circuit  
2 further includes a position threshold circuit coupled to the first circuit, the position  
3 threshold circuit associating a gain with the audio signals from the second microphone  
4 for comparison with the audio signals from the first microphone.

1 47. The system according to Claim 46, wherein the position estimation circuit  
2 further includes a pulse stretching circuit in electrical communication with the position  
3 threshold circuit, the pulse stretching circuit maintaining the error signal for a period of  
4 time to enable the audio signals from at least one of the first microphone and the second  
5 microphone to be provided to the output.

1 48. The system according to Claim 47, wherein the pulse stretching circuit  
2 comprises a reset circuit causing the error signal to enable the audio signals from at least  
3 one of the first microphone and the second microphone to be provided to the output.

1 49. A headset, comprising:  
2 a supporting device adapted to be secured to a head of a user;  
3 a boom coupled to the supporting device and disposed proximate a desired  
4 acoustic source comprising a mouth of the user generating acoustic signals;

5 an acoustic pick-up device coupled to the boom and having a first microphone  
6 disposed at a first distance from a desired acoustic source, and a second  
7 microphone disposed at a second distance from the desired acoustic source,  
8 each of the first microphone and the second microphone  
9 receiving the acoustic signals, and  
10 in response, transducing the acoustic signals into audio signals;  
11 a position estimation circuit coupled to receive the audio signals from the first  
12 microphone and the second microphone, and adapted to produce therefrom an  
13 error signal representing an estimate of the acoustic pick-up device being  
14 positioned differently than intended with respect to the desired acoustic  
15 source, the position estimation circuit including a first circuit providing an  
16 average of corresponding magnitudes for the audio signals received from the  
17 first microphone and the second microphone to produce the error signal; and  
18 a controller using the error signal to compensate for the acoustic pick-up device  
19 being positioned differently than intended by providing the audio signals  
20 from at least one of the first microphone and the second microphone to an  
21 output.

1 50. The system according to Claim 49, wherein the first circuit comprises a first  
2 absolute value detector and a first envelope detector receiving the audio signals from the  
3 first microphone, and a second absolute value detector and a second envelope detector  
4 receiving the audio signals from the second microphone.

1           51. A system for controlling a directional response of at least one of a first  
2 microphone and a second microphone, the system comprising:  
3           first microphone means disposed at a first distance from a desired acoustic source;  
4           second microphone means disposed at a second distance from the desired acoustic  
5           source, each of the first microphone means and the second microphone  
6           means receiving acoustic signals generated from the desired acoustic source,  
7           and in response thereto, transducing the acoustic signals into audio signals;  
8           position estimation means coupled to receive the audio signals from the first and  
9           second microphone means, the position estimation means being adapted to  
10           produce therefrom an error signal representing an estimate of the first and  
11           second microphone means being positioned differently than intended with  
12           respect to the desired acoustic source, the position estimation means  
13           including means for averaging corresponding magnitudes for the audio  
14           signals received from each of the first and second microphone means to  
15           produce the error signal; and  
16           control means using the error signal to compensate for the first and second  
17           microphone means being positioned differently than intended by providing  
18           the audio signals from at least one of the first and second microphone means  
19           to an output.

1           52. The system according to Claim 51, wherein said control means adjusts a polar  
2 pattern of the audio signals received from the first and second microphone means to  
3 provide the audio signals to the output.

1           53. The system according to Claim 51, wherein the audio signals provided to the  
2           output include noise canceling from a combination of the audio signals from both the first  
3           and second microphones.

1           54. A method of controlling a directional response of at least one of a first and  
2           second microphones, the method comprising:  
3           receiving acoustic signals generated by a desired acoustic source at a first  
4           microphone;  
5           receiving the acoustic signals at a second microphone;  
6           in response, the first and second microphones each transducing the acoustic  
7           signals respectively received into audio signals;  
8           { determining an average of corresponding magnitudes of the audio signals for each  
9           { of the first microphone and the second microphone;  
10          detecting an error signal amongst the audio signals, the error signal representing  
11          an estimate of the average determined for each of the first and second  
12          microphones being positioned differently than intended with respect to the  
13          desired acoustic source;  
14          using the error signal to select the directional response corresponding to at least  
15          one of the first and second microphones in order to compensate for the first  
16          and second microphones being positioned differently than intended; and  
17          providing the audio signals associated with the directional response selected to an  
18          output.

1           55. The method according to Claim 54, wherein detecting an error signal  
2 comprises determining a ratio of the audio signals associated with the first microphone  
3 with the audio signals associated with the second microphone.

1           56. The method according to Claim 55, further comprising:  
2 in response to the ratio determined, providing noise canceling microphone signals  
3 to the output.

1           57. The method according to Claim 54, wherein the audio signals provided to the  
2 output are a result of noise canceling determined by generating a difference between the  
3 audio signals associated with the first microphone and the audio signals associated with  
4 the second microphone.

1           58. The method according to Claim 54, further comprising  
2 activating an indicator in response to receiving the error signal to indicate the first  
3 and second microphones being positioned differently than intended with  
4 respect to the desired acoustic source.

1           59. The method according to Claim 54, wherein the first microphone comprises  
2 omnidirectional microphone and the second microphone comprises a directional  
3 microphone.

1           60. The method according to Claim 54, wherein the first and second microphones  
2 each comprises an omnidirectional microphone.

1 61. The method according to Claim 54, further comprising:  
2 determining progressive levels of the first and second microphones being  
3 positioned differently than intended with respect to the desired acoustic  
4 source;  
5 determining a corresponding phase shift based on a particular one of the  
6 progressive levels associated with the error;  
7 introducing the corresponding phase shift with the audio signals associated with  
8 the second microphone to produce delayed signals;  
9 providing at the output the delayed signals combined with the audio signals  
10 associated with the first microphone.

1 62. The method according to Claim 54, wherein the first microphone is disposed  
2 closer to the desired acoustic source than the second microphone.

1 63. The method according to Claim 54, wherein the directional response includes  
2 one of a figure eight pattern, a cardioid pattern, a hypercardioid pattern, and an  
3 omnidirectional pattern.

1 64. A method of sensing and compensating for an error, the method comprising:  
2 receiving acoustic signals generated by a desired acoustic source at a first  
3 microphone;  
4 receiving the acoustic signals at a second microphone;  
5 in response, the first and second microphones each transducing the acoustic  
6 signals respectively received into audio signals;

